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Method and device for demounting/remounting hammers, hammer axles and/or protective caps of rotors of hammer crushers

Background of the Invention

~~Field of technology~~

The invention relates to a method and device for demounting/remounting hammers, hammer axles and/or protective caps of the rotors of hammer crushers, which are used in particular for comminuting of generally metallic scrap.

Description of the Related Art

~~State of the technology~~

Hammer crushers consist essentially of a housing with a rotor supported in the housing, with the rotor composed of a plurality of disks or spiders which are non-rotatably disposed on a shaft and hammers distributed between them. The hammers are rotatably supported on hammer axes that extend through the disks in a parallel-eccentric relationship to the shaft, wherein the hammer axes also hold protective caps which cover the rotor to protect the rotor against wear.

In the comminution process, the rotor and in particular the hammers, protective caps and the hammer axles holding the caps are subjected to the different wear conditions.

At least during the so-called maintenance intervals, wear may require that the spent hammers and/or protective caps are replaced by new ones. This is done by driving, pulling or pressing the hammer axles out of their seat in the disks or spiders.

For this purpose, devices with, for example, a hydraulic drive are used which represent an independent unit that can only be used during maintenance, but has otherwise no connection with the actual operation of the hammer crusher.

Depending its operating mode, design and efficiency, such device which is frequency referred to as a hammer axle pulling device, is important not only for of changing hammers and protective caps the hammer crusher, but also for an the increased uptime of the hammer crusher.

Pulling the hammer axles can be difficult because the hammer axles are not only subjected to frictional wear, but also experience significant upsetting deformation. Accordingly, the hammer axles may have to be driven with very large forces through the bores of the disks or spiders, meaning that after its useful operating life, the respective hammer axle has both smaller and larger diameters as compared to the original manufacturing dimensions.

The hammer axle pulling devices used to this date consists primarily of a moveable frame that can be moved manually, connecting rods secured to the frame and moveable thereto, which require significant space and are of complex design, so that the required maintenance has an unfavorable effect on the uptime of the hammer crusher system.

Summary of the invention

It is therefore the object of the invention to provide a method and a device, which simplifies demounting and remounting of hammers, hammer axles and/or protective caps in hammer crushers by eliminating the need for cross members and allowing a compact design of the device, by reducing manufacturing cost and by altering the sequence of steps required for demounting and remounting with the method to increase the uptime of the hammer crusher through reduced maintenance times.

This is solved by the invention by the characterizing features of claims 1 to 13.

The overall advantages of the invention and solution to the aforedescribed object

of the invention are based on the fact that the method with the device can eliminate the use of pulling rods which reduces the required space for the pulling operation, so that the working platforms surrounding the hammer crusher, buildings and/or sound proofing walls can be set up closer to the hammer axle pulling device. Moreover, the drive can move the cross member close to the rotor, without requiring extensive manual labor for moving a carriage. Finally, the compact construction reduces manufacturing cost and investment expenses for building a hammer crusher, and the operating mode according to the invention increases the uptime of a hammer crusher plant.

Brief description of the drawings

The invention will be described in more detail with reference to an embodiment. The corresponding drawings show in

Fig. 1 a schematic diagram of the process flow and the construction of the invention with the functions
a) hammer axle pulling device in ready mode,
b) establishing the connection between cross member and the rotor,
c) pulling to the hammer axle in 3 strokes,

Fig. 2 the basic construction of the hammer axle pulling device with a hydraulic drive in releaseable effective connection to the rotor of the hammer crusher shown in a longitudinal cross-sectional view, and

Fig. 3 a front view of the rotor of Fig. 2, initially without the features of the hammer axle pulling device, wherein the detailed view A-A shows the section taken along the line A-A of Fig. 2, with the section taken along B-B shown as detail B-B.

Detailed Description of the Presently Preferred Embodiments

~~Best mode for carrying out the invention~~

To provide a better understanding of the technological and constructive relationships, a rotor 1 supported in a housing (not shown) of a hammer crusher will be described first with reference to Figs. 2 and 3. The rotor is made of several disks 1.2 or spiders that are non-rotatably disposed on a shaft 1.1, and of hammers 1.3 distributed between them, wherein the hammers 1.3 are rotatably supported on hammer axles 1.5 that are guided through the disks 1.2 parallel to and eccentrically with respect to the shaft 1.1. The hammer axles 1.5 also hold protective caps 1.4 which protect the rotor 1 and the disks 1.2 against wear. The hammer axles 1.5 are secured in the axial direction with releaseable locking elements 1.7 which are affixed to the outer disks 1.2. Finally, openings, such as slots 1.6, which form corresponding attachment elements for a hammer axle pulling device 2 depicted in Fig. 1, are provided on the outer disks 1.2 to allow demounting and remounting of the hammers 1.3, hammer axles 1.5 and protective caps, as described above.

The hammer axle pulling device 2 according to the invention consists of a drive unit 2.8 which is connected to a lockable moveable slide 2.4 that can be moved on an anchored rail frame 2.9. The drive unit 2.8 has a cross member 2.1 with fixing elements 2.3, such as hammer head bolts, which engage with or engage behind the aforedescribed openings 1.6. Both the entire slide 2.4 and the cross member 2.1 can move relative to one another and to the rotor 1. A pulling head 2.2 is affixed, on one hand, on the hammer axle 1.5 after removal of the locking element 1.7 and, on the other hand, connected to the slide 2.4 for arrangement in several relative positions thereto.

The drive unit 2.8 consists of two hydraulic cylinders 2.8.1, 2.8.2 which are affixed to the slide 2.4 and include piston rods 2.8.3, 2.8.4 that are connected by the cross member 2.1. Alternatively, the drive unit 2.8 can also consists of an electric motor (not shown) with a spindle, whereby the spindle is connected to the cross member 2.1 by a threaded element.

The cross member 2.1 includes as fixing elements 2.3 the aforementioned hammer head screws, which engage in the corresponding slots or openings 1.6 of the end disks 1.2 or of a similar element of the rotor 1. The hammer head screws engage behind the end disks 1.2 by being rotated with locking levers 2.6 and are secured by nuts 2.7 (Fig. 3, B-B). In this position, the cross member 2.1 is in a fixed and releaseable connection with the rotor 1.

The pulling head 2.2 is connected with the slide 2.4 by a releaseable element 2.5, such as an insertable interlocking device, whereby the pulling head 2.2 can be locked on the slide 2.4 in several spacings/positions (Fig. 3, A-A). For this purpose, the slide 2.4 as several suitable insertion positions.

When the piston rods 2.8.3, 2.8.4 (Fig. 1a) are retracted, the slide 2.4 is arranged at such a spacing in the axial direction of the rotor 1 and locked on the anchored rail frame 2.9 that the spacing corresponds to the length of the respective hammer axle 1.5 plus tolerances, divided by the required or desired number of strokes (Fig. 1c) for pulling the hammer axle 1.5. The resulting position of the slide 2.4 is locked in position by the releaseable element 2.5 (Fig. 1b).

As a result, the hammer axle pulling device 2 is constructed so that the hammer axle 1.5, after having been completely pulled, rests in the slide 2.4 and can optionally be exchanged against a new hammer axle 1.5, with its position corresponding to the demounting and remounting position relative to the rotor 1.

It will be understood that the axle pulling device 2 implemented in this way can also be used for installing the hammer axles 1.5.

The method of the invention for demounting and remounting of hammers 1.3, hammer axles 1.5 and/or protective caps 1.4 during a repair using the hammer axle pulling device 2 is implemented by carrying out the following process steps:

a) exposing the rotor 1, which remains mounted in at least one part of the housing, and rotating and securing the same in an upper dead center position of die respective hammer axle 1.5;

b) affixing a pulling head 2.2 on an exposed end of the hammer axle 1.5 (Fig. 1b);

c) mounting a cross member 2.1 with fixing elements **2.2** of a hammer axle pulling device 2 in a position in which the fixing elements 2.3 match corresponding fixing elements 1.6 on a front face of the rotor 1 (Fig. 2, Fig. 3 A-A, B-B);

d) pulling a releasable element 2.5 of a slide 2.4 of the hammer axle pulling device 2 and keeping said releasable element 2.5 available;

e) producing a rigid and subsequently releasable connection between the fixing elements 2.3 of the cross member 2.1 and the fixing elements 1.6 of the rotor 1 (Fig. 3 B-B);

f) advancing the slide 2.4 of the hammer axle pulling device 2 to a position in which the pulling head 2.2 affixed on the hammer axle 1.5 is connected to the slide 2.4 with a positive fit by means of the releasable element 2.5 that is provided (Fig. 1b);

g) securing the position of the hammers 1.3 and optionally, of the protective caps 1.4;

h) retracting the slide 2.4 of the hammer axle pulling device 2 and simultaneously pulling the hammer axle 1.5 out to a first position in which at least one hammer 1.3 and/or optionally, a protective cap 1.4 can be removed freely (Fig. 1c, 1/3 stroke);

i) releasing the releasable connection between the pulling head 2.2 and the slide 2.4 using die releasable element 2.5;

j) once more, advancing the slide 2.4 to another position in which the pulling head 2.2 is again connected to the slide (2.4) with a positive fit;

k) once again, and optionally repeatedly, retracting the slide 2.4 and pulling the hammer axle 1.5 out to a position in which all hammers 1.3 and/or

protective caps 1.4 and optionally the hammer axle 1.5 are removed, thereby finishing the demounting step (Fig. 1c, 2/3 stroke, 3/3 stroke); thereafter remounting by

l) initially advancing the slide 2.4 connected to the new hammer axle 1.5, while subsequently reversing the order of the steps b) to k), as well as reversing the corresponding operational steps from the installation of the hammers 1.3 and/or protective caps 1.4 to the release of the fixing elements 2.3 of the cross member 2.1 of the slide 2.4 from the fixing elements 1.6 of the rotor 1 and removal of the cross member 2.1 by retracting the slide 2.4, as well as releasing attachment of the pulling head 2.2 with the hammer axle 1.5 and placing the rotor in the ready state for the comminution process.

The steps a) to l) are repeated depending on the remaining number of hammer axles 1.5 to be replaced in the rotor 1 and/or the number of the hammers 1.3 and/or protective caps 1.4 to be replaced.

It should be noted in the process flow that the blocking element 1.7 that secures the hammer axle 1.5 is first released and then reinstalled after the remounting operation is complete.

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The releasable connection in process step c) is established by rotating the locking lever 2.6 and the fixing elements 2.3 of the cross member 2.1, which are formed as hammer head screws and secured with nuts 2.7, and engaging the same behind the fixing elements 1.6 of the rotor, which are formed as openings or slots, whereby the cross member 2.1 is affixed to the rotor 1.

The process flow can also include that during a demounting phase of a hammer 1.3 and/or a protective cap 1.4 the respective element 1.3, 1.4 can be remounted in case of a partial wear by rotating them 180° in the opposite effective direction.

Industrial applicability

The invention has industrial applicability because demounting and remounting require only a small clearance, the peripheral devices can be installed closer to the more compact hammer crusher system, so that the function according to the invention facilitates repair and increases the availability of the system.

List of reference numerals

1 =	rotor
1.1 =	shaft
1.2 =	disk
1.3 =	hammer
1.4 =	protective camp
1.5 =	hammer axle
1.6 =	fixing elements, opening, slot
1.7 =	locking element
2 =	hammer axle pulling device
2.1 =	cross member
2.2 =	pulling head
2.3 =	fixing element, hammer head screw
2.4 =	slide
2.5 =	releasable element, blocked
2.6 =	locking lever
2.7 =	nut
2.8 =	drive unit
2.8.1 =	hydraulic cylinder
2.8.2 =	hydraulic cylinder
2.8.3 =	piston rod
2.8.4 =	piston rod
2.9 =	rail frame